REMARKS

For convenience in responding to the Final Office Action dated March 25, 2010, reference is made herein to the section numbers used in the Action.

Section 2

The specification has been amended to overcome the objection to the specification relating to the description "the maximum thickness of the area ... is 10 μm or more." More specifically, the paragraph beginning in line 20 on page 6 has been amended to read:

> In the layered product of the invention, it is preferred that in the thermoplastic resin layer, the maximum thickness (Tpf-max as hereinafter defined and as shown in Fig. 2) of the area where the continuous filaments exist is 10 μm or more. It is preferred that the maximum thickness Tpf-max is 1,000 μm or less.

The paragraphs beginning in lines 6 and 23 on page 25 have also been amended for consistency with the amendments to the paragraph on page 6.

The specification as amended is believed to be clear. The maximum thickness Tpf-max is defined in the specification on page 25, lines 11-19, with reference to Fig. 2 of the drawings.

As can be seen by referring to Fig. 2, the thermoplastic resin layer has peaks and valleys at the rugged interface. The highest

peak corresponds to the maximum thickness of the thermoplastic layer where the continuous filaments exist. The highest peak (maximum thickness) of the thermoplastic layer is a measure of the ruggedness of the interface (and of penetration of the thermoplastic layer into the thermosetting layer and varies within a range that is at least 10 microns (in thickness).

The interpretation of the Office, i.e., "the thickness of the area where the continuous filaments exist is 10 μm or more" is not correct because, as can be seen by referring to Fig. 2, continuous filaments also exist in the area of the thermoplastic layer identified as Tpf-min. The thickness of this area is inherently less than 10 μm, i.e., the minimum thickness of the highest peak.

Removal of the objection to the specification is requested.

Section 4

In this section of the Final Action, claim 39 is rejected under the first paragraph of 35 U.S.C. § 112 as not finding proper descriptive support in the specification.

Claim 39 has been amended substantially as proposed by the Office in Section 5 of the Final Action (except as explained below with respect to the rejection in Section 5 of the Action). Claim 39 as amended is believed to comply with the written description requirement of the first paragraph of 35 U.S.C. § 112.

Removal of the 35 U.S.C. § 112, first paragraph, rejection is also requested.

Section 5

In this section of the Final Action, claims 1, 3, 5-8, 11-13, 16, 17, 19 and 39 are rejected as being indefinite under the second paragraph of 35 U.S.C. § 112.

The claims have been amended as explained below to overcome this rejection. (It is noted that reference to line numbers are those identified by the Office in the Final Action and correspond to line numbers of the claims as amended in the response filed December 24, 2009, to the Office Action dated June 24, 2009).

First, claim 1 has been amended to change the limitation "parallel to the surface of the layered product" in line 23 to --parallel to the first and second opposed surfaces of the layered product-- and to change the limitation "the surface of the thermoplastic resin layer" in lines 31-32 and 34 to to --the second opposed surface--. It is noted that the recitation "second opposed surface" is believed to be clear without the additional recitation "of the thermoplastic resin layer" since claim 1 recites that the thermoplastic resin layer forms at least part of the second opposed surface of the layered product.

Claim 6 has been amended to change the limitation "the molded

object" to --the layered product--.

Claim 7 has been amended to change each occurrence of the limitation "face of said thermoplastic resin layer" to --second opposed surface-- and to change the limitation "the surfaces of said molded object" in lines 6-7 to --opposing surfaces of said molded object--.

Claim 17 has been amended to change the limitation "parallel to the surface of the layered product" in lines 26-27 to --parallel to the first and second opposed surfaces of the layered product--; to change the limitation "said rugged interface" in line 27 to --said continuous rugged interface--; and to change the limitation "the surface of the thermoplastic resin layer" in lines 33-34 and 36 to --the second opposed surface--.

Claim 39 has been amended to overcome the rejections relating to the limitations in sections (f) and (g) of the claim by amending sections (f) and (g) to read as follows:

> (f) said continuous rugged interface is formed between [[an]] a maximum innermost filament in the resin of said thermoplastic resin layer ~~in the region~~ where the thickness of the resin of said thermoplastic resin layer from the ~~surface of the thermoplastic resin layer~~ second opposed surface is largest and ~~an outermost~~ a minimum

innermost filament in the resin of said thermoplastic resin layer in the region where the thickness of the resin of said thermoplastic resin layer from the ~~surface of the thermoplastic resin layer~~ second opposed surface is smallest;

and wherein,

(g) a distance between ~~an outermost~~ the maximum innermost filament in said filaments in the resin of said thermoplastic resin layer in the thickness direction thereof and the minimum innermost filament ~~in said filaments in contact with the resin of said thermoplastic resin layer in the region where the thickness of the resin of said thermoplastic resin layer from the surface of said thermoplastic resin layer is largest~~ is 10 μm or more.

Section (f) as amended corresponds to section (f) as proposed by the Office on page 6 of the Final Action. Section (g) has been revised for consistency with section (f) and to define the distance recited therein as being between the maximum innermost filament and the minimum innermost filament in said filaments in the resin of said thermoplastic resin layer in the thickness direction thereof. Section (g) as amended is believed to be consistent with and to

find descriptive support in the description in the specification of the present application on page 25, line 6, to page 26, line 4, and in Fig. 2.

The amendments to the claims do not raise new issues or require further search. Entry of the amendments and removal of the 35 U.S.C. § 112, second paragraph, rejections are requested.

Section 6

In this section of the Final Action, claims 1, 3, 5, 6, 8, 11-13, 16, 17, 19, 20 and 39 are rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Evans et al., US 4,604,319 ("Evans").

Applicants respectfully submit that Evans is insufficient to support the anticipation and, alternative, obviousness rejections.

Anticipation of a claim under 35 U.S.C. §102 requires the disclosure in a single prior art reference of every limitation of the claimed invention, either explicitly or inherently. The claim limitation or limitations must necessarily be included in the prior art reference in order for the reference to anticipate. Inherency may not be established by possibilities or probabilities. The fact that a limitation might result from the disclosure of a reference is not sufficient. In re Oelrich, 666 F.2d 578, 581, 212 USPQ 323, 326 (CCPA 1981) and In re King, 801 F.2d 1324, 1326, 231 USPQ 136,

138 (Fed. Cir. 1986).

Nothing in Evans supports a conclusion that the fiber resin matrix composites of Evans will necessarily include a continuous rugged interface between the thermoplastic resin layer and the thermosetting resin layer, the continuous rugged interface having a structure such that some of said reinforcing continuous filaments parallel to opposed surfaces of the layered product extend through the continuous rugged interface and exist in the resin of said thermoplastic resin layer and also exist in the resin of said thermosetting resin layer as required by the claims of the present application.

To the contrary, the teachings of Evans support a conclusion that a continuous rugged interface as required in the claims of the present application is not formed.

First, at column 3, lines 46-54, Evans describes:

> On a microscopic level, there may be an extremely thin layer 30 at the matrix resin/interleaf resin interface, characteristic of adhesive-type bonding, where the thermoplastic interleaf material dissolves slightly in the matrix resin; however, aside from this bonding interface, the interleaf material must be capable of maintaining a discrete interleaf layer, and no general

intermixing of the interleaf layer and resin matrix layer occurs (Fig. 4).

At column 8, lines 45-48, Evans describes:

> Most preferably, the interleaf resin will be slightly soluble in the uncured or partially cured thermosetting matrix resin at temperatures used to form the composites.

These teachings support a conclusion only that thermoplastic resin is dissolved slightly in the thermosetting resin and, consequently, that the thermoplastic interleaf material and the matrix resin are not integrated at a continuous rugged interface between layers of the thermoplastic interleaf material and the matrix resin.

The teachings of Evans do not support a conclusion that the thermoplastic resin is melted at the temperatures used to form the composite in Evans. In contrast, in the present invention, the thermoplastic resin must be melted to produce a layered product as defined in claim 1 or 39. (See, for example, page 36, lines 6-10, of the specification of the present application).

Second, at column 7, lines 48-53, Evans describes:

> The thermoplastic resin of the interleaf comprises a high molecular weight engineering thermoplastic, much as a polyester, a polyamide, a polyaramid, a polyarylate, a

> polycarbonate, a poly(ester carbonate), a polybenzimidazole, a polyimide, a polyether imide, a polyamide imide, and the like.

These polymers have a melting point of more than 200 °C.

At column 7, lines 53-57, Evans describes:

> Preferably the thermoplastic will be a poyether ketone, abbreviated PEEK, a polyimide, e.g. KAPTON, or a polyether imide, e.g. ULTEM.

PEEK has a melting point of 340 °C. KAPTON has no melting point and is carbonized at a higher temperature. ULTEM has no melting point and has a glass transition temperature of 217 °C.

At column 8, lines 48-52, Evans describes:

> The interleaf resin must, of course, also be able to survive the curing temperatures, usually about 350° F [180 °C], that the composites are subjected to.

And, at column 9, lines 27-28, Evans describes:

> Composites were stacked and autoclave cured at 350° F [180 °C] and 100 psi for 2 hours to produce a structural part.

It is clear from these descriptions that the processing temperature to produce a composite in Evans is about 180 °C and that the disclosed thermoplastics have a melting point of more than

200 °C or have no melting point. Therefore, during formation of a composite in Evans the interleaf thermoplastic resin is not melted, i.e., it is only slightly dissolved into the thermosetting resin and does not penetrate into the thermosetting resin layer and reinforcing continuous filaments 2 existing in a thermosetting resin layer 10 (or a fiber resin matrix layer 18) are not taken into an interleaf thermoplastic resin layer 22. Consequently, the reinforcing continuous filaments 2 exist only in the thermosetting resin layer 10 and do not exist in the thermoplastic resin layer 22. That is, the reinforcing continuous filaments 2 do not exist in both the thermosetting resin layer 10 and the thermoplastic resin layer 22. In contrast, in the present invention, in the continuous rugged interface required by the claims, reinforcing continuous filaments exist in both a thermosetting resin layer and a thermoplastic resin layer.

In light of the foregoing, it is clear that Evans is not sufficient to support a case of anticipation of the claims of the present application.

Regarding obviousness, the Office asserts in the Final Action that "it would have been obvious to one having ordinary skill in the art at the time the invention was made to have varied the temperature and conditions under which this composite was made to

any amount in order to allow the reinforcing filaments 2 of the fiber resin matrix 18 to penetrate into the thermoplastic interleaf material 22 to any depth, including at least 10 μm as claimed. The rationale behind this is that these reinforcing filaments would provide sturdiness to the laminate, … . This is mere experimantal optimization." (Final Action, page 8, lines 9-18).

The position of the Office is mere speculation unsupported by the prior art. Optimization to support obviousness requires that a variable be recognized as a result-effective variable. Nothing in Evans, considered as a whole, establishes that pressure and temperature are result-effective variables to obtain the fiber resin matrix composites of the invention disclosed therein.

Evans, in fact, in view of the disclosure of specific conditions and materials required to obtain the composites and in view of the descriptions therein leads away from a conclusion that temperature and conditions under which the composite are made can be varied to any amount in order to allow the reinforcing filaments of the fiber resin matrix to penetrate into the thermoplastic interleaf material. More specifically, Evans, beginning in Col. 7, line 63, teaches:

> In addition, it may be advantageous in the practice of the present invention to utilize reinforcing materials in

> the interleaf, such as mat scrim, whiskers, particulates, chopped fibers or other second phase reinforcement, and in general the reinforcing material may suitably be employed in various amounts, such as for example up to about 50% by weight based on the total weight of the interleaf.

This description suggests that reinforcing materials must be added to the interleaf prior to forming the fiber resin composites and rebuts the position of the Office that optimizing conditions would allow the reinforcing filaments of the fiber resin matrix to penetrate into the thermoplastic interleaf material.

Evans does not properly support a case of prima facie obviousness under 35 U.S.C. § 103(a) of the layered product and molded object of the present invention as defined in the amended claims.

Removal of the 35 U.S.C. § 102(b) and, alternative, 35 U.S.C. § 103(a) rejections is in order.

Section 7

In this section of the Final Action, claim 7 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Evans.

This rejection depends on the sufficiency of Evans to support the above-discussed rejections of claim 1 of the application.

Evans, for the above reasons, is not sufficient to support the rejections of claim 1 under 35 U.S.C. § 102 and 35 U.S.C. § 103(a). Therefore, claim 7 is prima facie patentable over Evans.

Sections 8 and 9

In these sections of the Final Action, claims 1, 3, 5-8, 11-13, and 39 are rejected under 35 U.S.C. § 103(a) as obvious over Obara, JP 07-047152, in view of Nishimura et al., JP 07-112039 ("Nishimura"), and Claims 16, 17, 19 and 20 are rejected under 35 U.S.C. § 103(a) as obvious over Igakura et al., JP 09-277420 ("Igakura") in view of Obara and Nishimura.

The Office takes the position in these rejections that Obara discloses a layered product including the limitations of the layered product of the invention as defined in claims 1, 5 and 39, except that Obara "does not specifically teach the thickness of the area where said continuous filaments exist in said thermoplastic layer." (Final Action, page 12, lines 4-5 from the bottom of the page). Regarding the limitation in the claims of the present application of a "continuous rugged interface", the Office asserts, referring to Figs. 3 and 4 of Obara that "[t]he intermingling of **4** and **6** [thermosetting material layer] with **5** and **7** [thermoplastic layer] at the boundary between **6** and **7** reads on applicants' rugged interface region." (Final Action, page 12, lines 7-9 from the

bottom of the page).

Submitted herewith to show that the boundary of the fiber reinforced thermosetting resin and the fiber reinforced thermoplastic resin where the thermosetting resin and the thermoplastic resin or the thermosetting resin, the thermoplastic resin and the reinforcing fibers are "intermingled with each other" in the racket frame of Obara is not a "continuous rugged interface" as recited in the claims of the present application, is a declaration under 37 C.F.R. § 1.132 of the inventor Masato HONMA. The photographs attached to the declaration show that there is no interface of a thermosetting resin layer and a thermoplastic resin layer in the product of Obara and nothing that can be characterized as a continuous interface between a thermosetting resin layer and a thermoplastic resin layer.

Moreover, that the area of the product of Obara where the resins are intermingled cannot be properly characterized as an interface is evidenced by the disclosure of Obara itself. As explained in the response filed December 24, 2010, to the Office Action dated June 24, 2010, Obara distinguishes the "domain" of its product where the thermosetting resin and the thermoplastic resin are "intermingled" (Example 3) (page 13, lines 6-9, of the English translation submitted with the response) with that where an

"interface" exists between the thermosetting resin and the thermoplastic resin in a comparative product (Comparative Example 2) (page 13, paragraph [0026] of the English translation submitted with the response).

Since Obara does not disclose a layered product including each of the limitations of claims 1, 5 and 39 and, more particularly, does not disclosed a layered product having a continuous rugged interface as recited and defined in these claims, the 35 U.S.C. § 103(a) rejections cannot stand and must be removed.

A notice of allowability of the claims of the application is believed to be in order and is respectfully solicited.

The foregoing is believed to be a complete and proper response to the Office Action dated March 25, 2010.

In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time.

The fee for any such extension and any additional required fees may be charged to Deposit Account No. 111833.

Respectfully submitted,

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PATENT APPLN. NO. 10/540,624 **PATENT**
SUBMISSION UNDER 37 C.F.R. § 1.114

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Attachment: Declaration under 37 C.F.R. § 1.132 of Masato HONMA